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EXAMINER	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/780,500	OH, BYONG MOK	
	Examiner	Art Unit	
	Crystal Murdoch	2628	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 August 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3,5-28 and 32-37* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3,5-28 and 32-37* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *17 February 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

I. Response to Arguments

Applicants' response to the last Office Action, mailed 17 May 2007, has been entered and made of record.

The rejections of claims 4 and 29-31 are rendered moot by applicant's cancellation of those claims.

Applicant's arguments, see pages 13-15 of Applicant's remarks, filed 27 August 2007, with respect to the rejection(s) of claims 1-3, 5-28, and 32-37 under 35 U.S.C. §103, in view of Katayama, have been fully considered and are persuasive. Examiner is persuaded by Applicant's assertion that there would not have been a reasonable expectation of success by combining the three-dimensional object extraction method suggested by Katayama with the three-dimensional panoramic mosaic methods of Szeliski. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of the combination of Szeliski, Luken, Seago, and Blank, as presented in the office action below.

II. Claim Rejections - 35 USC § 112

A. Second Paragraph - Indefinite

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 37 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 37 recites, "wherein the one or more editing tools comprises a ground plane tool, an extrusion tool, a depth chisel tool, and a non-uniform rational B-spline tool." It is unclear how one editing tool is comprised of multiple editing tools. Examiner believes Applicant intended for this limitation to read in the alternative, similar to claim 18, and will examine the claim as such.

B. Sixth Paragraph - Means-Plus-Function Interpretation

Regarding independent claim 32, the means-plus-function language will be interpreted as follows:

- Means for receiving one or more image panoramas representing a visual scene having one or more objects relates to a device "such as a

scanner, a digital camera, or other means for receiving, storing, and/or transferring digital images such one or more image panoramas, two-dimensional images, and three-dimensional images," as defined in paragraph 112 on page 27 of the specification.

- Means for allowing a user to interact with the system relates to a mouse or other pointing and dragging device such as a track ball to orient the panorama, as defined in paragraph 84 on page 18 of the specification. This interaction means is interpreted to be the means for determining a directional vector for each image panorama and aligning the image panoramas relative to each other.
- Means for creating a three-dimensional model from the aligned panoramas relates to interactive software tools for defining the geometries and textures of elements within the image as defined in paragraph 99 on page 23 of the specification.

III. Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

A. Claims 1-3, 5-6, 8-10, and 32-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Szeliski et al. (US Patent Number 6,157,747, herein referred to as Szeliski), in view of Luken (US Patent Number 5,923,334), in further view of Seago (US Patent Number 5,990,900).

Regarding independent claim 1, a computerized method for creating a three dimensional model from one or more image panoramas, the method comprising:

- Receiving one or more image panoramas representing a visual scene and having one or more objects (See Szeliski: Fig. 6; Col. 4, Lns. 66-67, wherein the invention creates full view panoramic mosaics from image sequences. Col. 11, Lns. 16-21 teaches the presence of objects within the panoramic images.);
- Determining a directional vector indicating an orientation of the visual scene with respect to a reference coordinate system (See Szeliski: Fig. 15; Col. 22, Lns. 4-9, wherein the unit vector indicates the ray direction in the final composite image mosaic.);
- Transforming the image panoramas such that the directional vectors are substantially aligned relative to the reference coordinate system

(See Szeliski: Figs. 11 and 15; Col. 22, Lns. 2-4, wherein a bundle of rays is adjusted so they converge to one point.);

- Aligning the transformed image panoramas to each other (See Szeliski: Fig. 17; Col. 23, Lns. 10-12, wherein minimizing the differences between ray directions aligns the images.); and
- Creating a three dimensional model of the visual scene from the transformed and aligned image panoramas using the reference coordinate system (See Szeliski: Col. 5, Lns. 15-19, wherein the three-dimensional model of the scene is the texture-mapped polyhedron surrounding the origin, which can be viewed or explored using standard 3D graphics viewers.).

Szeliski does not expressly disclose determining a directional vector for *each* image panorama. Nevertheless, Luken is cited for teaching eight direction vectors D0-D7 associated with six rectangular images mapped to the inside of an octahedron (See Luken: Figs. 7-10, 14 and 17; Col. 7, Lns. 28-36, wherein it is determined which of the six rectangular images is intersected by one of the eight direction vectors.). It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to have used direction vectors for each image within an

environment map that is mapped to the sides of an octahedron, as taught by Luken, with the three-dimensional model environment map of the visual scene, as taught by Szeliski, because Luken: (1) is directed to the same problem of using polyhedral environment maps to create and view three dimensional images from data representing multiple views of a scene; (2) is in the same field of endeavor of image processing systems; and (3) Luken expressly suggests that the direction vectors provide an efficient system for generating and viewing three-dimensional panoramic images based environment maps, and offer an improved level of interactive graphical feedback (See Luken: Col. 3, Lns. 5-8).

Though Szeliski teaches creating a three-dimensional model of the visual scene (See Szeliski: Col. 5, Lns. 15-19, wherein the three-dimensional model of the scene is the texture-mapped polyhedron surrounding the origin.), Szeliski does not expressly suggest creating three-dimensional objects within the scene by individually modeling selected objects within the scene, and thus does not expressly suggest that creating a three dimensional model includes identifying a selected object in the transformed and aligned image panoramas and associating geometry information with the selected object, the geometry information

comprising 3-D coordinates describing the position and orientation of the selected object in the reference coordinate system.

Seago is cited for converting digitized two-dimensional images of objects into three-dimensional digital computer objects (See Seago: Col. 2, Lns.2-5). Specifically, with reference to figure 2, Seago begins the process with a digitized two-dimensional perspective image of one or more objects (See Seago: Fig. 2, Item 40; Col. 4, Lns. 34-36). Next, an object contained within the digital image is selected for conversion into a three-dimensional object by a user (See Seago: Fig. 2, Item 42; Col. 4, Lns. 46-53). The orientation of a three-dimensional coordinate space for the selected object is derived based on the calculated vanishing points, wherein the three-dimensional coordinate space is the screen world coordinate space (SWCS) with the origin located at the center of the perspective image (See Seago: Fig. 2, Item 50; Col. 5, Lns. 24-38). Therefore, Seago sufficiently teaches the claim limitations of creating a three dimensional model by identifying a selected object in a digital, two-dimensional image and associating geometry information with the selected object, the geometry information comprising 3-D coordinates

describing the position and orientation of the selected object in the reference coordinate system.

It is noted that, while the exemplary embodiment of Seago is an implementation of the invention using only a single input image, the system can also use two or more input images. In this case the steps illustrated in figures 6A and 6B are applied to all images (See Seago: Col. 11, Lns. 45-47). Seago merely requires an input of perspective images in order to properly implement the disclosed method. Szeliski teaches that, "any deviations from the pure parallax-free motion model or ideal pinhole (perspective) camera model may result in local misregistrations, which are visible as a loss of detail or multiple images (ghosting) (See Szeliski: Col. 3, Lns. 36-39)." This clearly conveys the intention of Szeliski to use perspective images as the input to the panoramic system. Since the images used in the image panoramic mosaics are perspective images, the methods taught by Seago to extract three-dimensional objects from perspective images could be implemented with the teachings of Szeliski to extract three-dimensional images from a panoramic mosaic of perspective images.

Therefore, it would have been obvious to one of ordinary skill in the art, at the time the invention was made, to have used the three-dimensional object extraction method, as taught by Seago, to extract three-dimensional objects from the perspective images of the panoramic mosaic, as taught by Szeliski, as modified by Luken, because Seago is in the same field of endeavor of generating three-dimensional computer graphics using image capture devices; and Seago expressly suggests that this method of object extraction produces accurate three-dimensional objects more efficiently than conventional systems that try to extract the three-dimensional objects using analytical mathematical interpretations and orthogonal image analysis (See Seago: Col. 11, Lns. 49-55).

Regarding independent claim 32, Szeliski teaches a system for creating a three dimensional model from one or more image panoramas, the system comprising:

- Means for receiving one or more image panoramas representing a visual scene having one or more objects (See Szeliski: Fig. 2B, Item 210; Col. 9, Lns. 6-9, wherein the means for receiving image panoramas is a digital/electronic camera, a still camera, or a video

camera,, or film or photographic scanner, which captures a sequence of images.);

- Means for allowing a user to interact with the system to determine a directional vector for the image panorama (See Szeliski: Fig. 2A, Items 40 and 42; Col. 8, Lns. 30-34, wherein a user may enter commands and information into the personal computer 20 through input devices such as a keyboard 40 and pointing device 42. Other input devices (not shown) may include a microphone, joystick, game pad, satellite dish, scanner, or the like.);
- Means for aligning the image panoramas relative to each other (See Szeliski: Fig. 2A, Items 40 and 42; Col. 8, Lns. 30-34, wherein a user may enter commands and information into the personal computer 20 through input devices such as a keyboard 40 and pointing device 42. Other input devices (not shown) may include a microphone, joystick, game pad, satellite dish, scanner, or the like.); and
- Means for creating a three-dimensional model from the aligned panoramas (See Szeliski: Col. 27, Lns. 64-66, wherein the shape of the model and the embedding of each face into texture space are left up to the user.).

Szeliski does not expressly disclose determining a directional vector for *each* image panorama. Nevertheless, Luken is cited for teaching eight direction vectors D0-D7 associated with six rectangular images mapped to the inside of an octahedron (See Luken: Figs. 7-10, 14 and 17; Col. 7, Lns. 28-36, wherein it is determined which of the six rectangular images is intersected by one of the eight direction vectors.). It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to have used direction vectors for each image within an environment map that is mapped to the sides of an octahedron, as taught by Luken, with the three-dimensional model environment map of the visual scene, as taught by Szeliski, because Luken: (1) is directed to the same problem of using polyhedral environment maps to create and view three dimensional images from data representing multiple views of a scene; (2) is in the same field of endeavor of image processing systems; and (3) Luken expressly suggests that the direction vectors provide an efficient system for generating and viewing three-dimensional panoramic images based environment maps, and offer an improved level of interactive graphical feedback (See Luken: Col. 3, Lns. 5-8).

Szeliski does not expressly disclose creating a three dimensional model by identifying a selected object in the aligned image panoramas and associating geometry information with the selected object, the geometry information comprising 3-D coordinates describing the position and orientation of the selected object in a reference coordinate system.

Seago is cited for converting objects within digitized two-dimensional images into three-dimensional digital computer objects (See Seago: Col. 2, Lns.2-5). Specifically, with reference to figure 2, Seago begins the process with a digitized two-dimensional perspective image of one or more objects (See Seago: Fig. 2, Item 40; Col. 4, Lns. 34-36). Next, an object contained within the digital image is selected for conversion into a three-dimensional object by a user (See Seago: Fig. 2, Item 42; Col. 4, Lns. 46-53). The orientation of a three-dimensional coordinate space for the selected object is derived based on the calculated vanishing points, wherein the three-dimensional coordinate space is the screen world coordinate space (SWCS) with the origin located at the center of the perspective image (See Seago: Fig. 2, Item 50; Col. 5, Lns. 24-38). Therefore, Seago sufficiently teaches the claim limitations of creating a three dimensional model by identifying a selected object in a digital, two-

dimensional image and associating geometry information with the selected object, the geometry information comprising 3-D coordinates describing the position and orientation of the selected object in the reference coordinate system.

Therefore, it would have been obvious to one of ordinary skill in the art, at the time the invention was made, to have used the three-dimensional object extraction method, as taught by Seago, to extract three-dimensional objects from the perspective images of the panoramic mosaic, as taught by Szeliski, because Seago is in the same field of endeavor of generating three-dimensional computer graphics using image capture devices; and Seago expressly suggests that this method of object extraction produces accurate three-dimensional objects more efficiently than conventional systems that try to extract the three-dimensional objects using analytical mathematical interpretations and orthogonal image analysis (See Seago: Col. 11, Lns. 49-55).

Regarding claim 2, as it depends from claim 1, Szeliski teaches the directional vector is determined based, at least in part, on instructions identifying elements of the image panorama received from a user (See Szeliski: Col. 8, Lns. 30-32 and Col. 27, Lns. 64-66).

Regarding claim 3, as it depends from claim 2, Szeliski teaches a method wherein the instructions from the user identify two or more substantially parallel features in the image (See Szeliski: Col. 20, Line 64 – Col. 21, Line 6 and Lines 25-34).

Regarding claim 5, as it depends from claim 2, Szeliski teaches a method wherein the instructions from the user identifying a horizon line of the image panorama (See Szeliski: Fig 4: Col. 9, Lns. 54-62).

Regarding claim 6, as it depends from claim 2, Szeliski teaches a method wherein the instructions comprise the identification of two or more areas of the image, each area containing one or more elements and further comprising automatically identifying the two elements contained in the two or more areas (See Szeliski: Fig. 6; Col. 20, Line 49 – Col. 21, Line 24, wherein a feature-based point correspondence is established between a pair of images by dividing each image into patches and identifying prospective "feature" points within the patches.).

Regarding claim 8, as it depends from claim 1, Szeliski does not expressly suggest that the image panoramas are aligned relative to the reference coordinate system such that the directional vector is at least

substantially parallel to one axis of the reference coordinate system. Nevertheless, Luken is cited for determining for each of the eight direction vectors D0, D1 ,D2 ... D7, which of the six axis-aligned, rectangular images is intersected by the direction vector Di (See Luken: Fig. 7, Item 707; Col. 6, Line 40—Col. 7, Line 36). It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to have aligned the direction vector with an axis of the reference coordinate system, as taught by Luken, with the panoramic mosaic method, as taught by Szeliski, because the numerical complexity of a vector representation is reduced if the vector is aligned with an axis.

Regarding claim 9, as it depends from claim 1, Szeliski does not expressly suggest that the image panoramas are aligned relative to the reference coordinate system such that the directional vector is at least substantially orthogonal to one axis of the reference coordinate system. Nevertheless, Luken is cited for determining for each of the eight direction vectors D0, D1 ,D2 ... D7, which of the six axis-aligned, rectangular images is intersected by the direction vector Di (See Luken: Fig. 6A and 7, Item 707; Col. 6, Line 40—Col. 7, Line 36). Since the six rectangular images are axis aligned, then a directional vector that is

parallel to one axis must be perpendicular to the other two spatial axes. In other words, in order for a directional vector to intersect one of the rectangular images, that vector must be substantially parallel to one axis, which requires it to be substantially perpendicular to the others. It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to have aligned the direction vector with an axis of the reference coordinate system, as taught by Luken, with the panoramic mosaic method, as taught by Szeliski, because the numerical complexity of a vector representation is reduced if the vector is perpendicular to an axis because it suggests that the vector is parallel with another axis.

Regarding claim 10, as it depends from claim 1, Szeliski teaches a method wherein the image panoramas are aligned according to instructions received from a user (See Szeliski: Col. 27, Lns. 64-66, wherein the user aligns the image panoramas into texture space.).

Regarding claim 33, as it depends from claim 32, Szeliski teaches a system wherein the input images comprise two-dimensional images (See Szeliski: Figs. 3-4; Col. 9, Lns. 56-58, wherein a camera 310 having its

optical center fixed at point C (FIG. 3) captures a sequence of 2D still images I_0, I_1, I_2, $I_{3...}$).

Regarding claim 34, as it depends from claim 32, Szeliski teaches the input images comprise three-dimensional images including geometry information (See Szeliski: Figs. 3-4 and 6; Col. 9, Lns. 56-62, wherein the camera captures a sequence of 2D still images (I_0, I_1, I_2, I_3.) as it pans, the center rays of these images being focused on 3D points (P_0, P_1, P_2, $P_{3...}$) at a focal length f from the optical center point C. The points P_i are defined relative to a fixed 3D world coordinate system (P_x, P_y, P_z). Since the three-dimensional images correspond to the two-dimensional images that include depth information in the form of focal length. The geometry information is the inverted V shape shown in both figures 4 and 6.).

Regarding claim 35, as it depends from claim 32, Szeliski teaches aligning the image panoramas according to instructions received from a user (See Szeliski: Col. 27, Lns. 64-66).

B. Claims 11-12, 22-28, and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Szeliski in view of Seago.

Regarding independent claim 11, Szeliski teaches a computerized method of interactively editing objects in a panoramic image, the method comprising:

- Receiving an image panorama representing a visual scene, the image panorama having one or more objects (See Szeliski: Fig. 6; Col. 4, Lns. 66-67, wherein the invention creates full view panoramic mosaics from image sequences. Col. 11, Lns. 16-21 teaches the presence of objects within the panoramic images.) and a point source (See Szeliski: Fig. 3, Item 310; Col. 9, Lns. 56-57, wherein the point source is camera 310 having its optical center fixed at point C.);
- Creating a three dimensional model of the visual scene using features of the visual scene and the point source (See Szeliski: Col. 5, Lns. 15-19, wherein the three-dimensional model of the scene is the texture-mapped polyhedron surrounding the origin (camera location or point source), which can be viewed or explored using standard 3D graphics viewers.);

Szeliski does not expressly disclose:

- Identifying a selected object in the image panorama and associating geometry information with the selected object, the geometry

information comprising 3-D coordinates describing the position and orientation of the selected object in a reference coordinate system;

- Receiving an edit to the selected object in the panorama;
- Transforming the edit relative to a viewpoint defined by the point source; and
- Projecting the transformed edit onto the selected object.

Seago is cited for converting digitized two-dimensional images of objects into three-dimensional digital computer objects (See Seago: Col. 2, Lns.2-5). Specifically, with reference to figure 2, Seago begins the process with a digitized two-dimensional perspective image of one or more objects (See Seago: Fig. 2, Item 40; Col. 4, Lns. 34-36). Next, an object contained within the digital image is selected for conversion into a three-dimensional object by a user (See Seago: Fig. 2, Item 42; Col. 4, Lns. 46-53). The shapes or polygons that define the selected object's sides relates to the geometry information, and are determined based on user designated vertices or vanishing lines at significant features of the selected object (See Seago: Fig. 2, Item 50; Col. 5, Lns. 35-38). Once all the polygons and plane indexes of a selected object have been determined, a three-dimensional object oriented within the selected object's three-dimensional coordinate space is determined (See Seago:

Fig. 2, Item 54; Col. 5, Lns. 50-53). Therefore, Seago sufficiently teaches the claim limitation of creating a three dimensional model by identifying a selected object in a digital, two-dimensional image and associating geometry information with the selected object, the geometry information comprising 3-D coordinates describing the position and orientation of the selected object in the reference coordinate system.

Furthermore, Seago teaches receiving an edit to the selected object in the panorama, transforming the edit relative to a viewpoint defined by the point source, and projecting the transformed edit onto the selected object in figure 3 and column 6, lines 1-34, as repeated in the following excerpt:

> "The viewpoint is along a normal to the image plane at the image's center. The three-dimensional coordinate space (SWCS) is set at the center of the perspective image. Next, at block 62, the intersection points between the image plane and the line-of-sight from the viewpoint to the endpoints of line segments extended to an approximate infinite point along each axis of the three-dimensional coordinate space (SWCS) are determined. In other words, the end of each axis is projected back to the image plane. At block 64, each calculated vanishing point is compared to the corresponding determined projected axis endpoint."
>
> "However, if the non-linear optimization algorithm determines that the error function is not at an acceptably low level, the three-dimensional coordinate space orientation and viewpoint focal length are adjusted based on the determined error function."

The edit instruction is received when decision block 70 in figure 3 branches along the "NO" path, indicating that the result of the error function is not sufficiently low. The edit is executed by adjusting the

orientation of the three-dimensional coordinate space. Once the edit is complete, the process loops back to block 62 in which the results of the edit in three-dimensions are transformed into 2D coordinates and projected back to the image plane along the line-of-sight. The line-of-sight corresponds to the viewpoint, and therefore the transform of the edit occurs relative to the viewpoint defined by the point source.

As previously noted, the exemplary embodiment of Seago only uses a single input image as input for the extraction process. Nevertheless, Seago teaches that the system can also use two or more input images. In this case the steps illustrated in figures 6A and 6B are applied to all images (See Seago: Col. 11, Lns. 45-47). Seago merely requires the input images to be perspective images in order to properly implement the disclosed method. Szeliski teaches that, "any deviations from the pure parallax-free motion model or ideal pinhole (perspective) camera model may result in local misregistrations, which are visible as a loss of detail or multiple images (ghosting) (See Szeliski: Col. 3, Lns. 36-39)." This clearly conveys the intention of Szeliski to use perspective images as the input to the panoramic system. Since the images used in the image panoramic mosaics are perspective images, the methods taught by Seago

to extract three-dimensional objects from perspective images could be implemented with the teachings of Szeliski to extract three-dimensional images from a panoramic mosaic of perspective images.

Therefore, it would have been obvious to one of ordinary skill in the art, at the time the invention was made, to have used the three-dimensional object extraction method, as taught by Seago, to extract three-dimensional objects from the perspective images of the panoramic mosaic, as taught by Szeliski, because Seago is in the same field of endeavor of generating three-dimensional computer graphics using image capture devices; and Seago expressly suggests that this method of object extraction produces accurate three-dimensional objects more efficiently than conventional systems that try to extract the three-dimensional objects using analytical mathematical interpretations and orthogonal image analysis (See Seago: Col. 11, Lns. 49-55).

Regarding independent claim 22, Szeliski teaches a method for projecting texture information onto a geometric feature within an image panorama (See Szeliski; Fig. 2B, Item 270; Col. 27, Lns. 62-66), the method comprising:

- Receiving instructions from a user identifying a three-dimensional geometric surface within an image panorama (See Szeliski: Col. 27-28, Lns. 62-2, respectively, wherein, "The shape of the model and the embedding of each face into texture space are left up to the user. This choice can range from something as simple as a cube with six separate texture maps, to something as complicated as a subdivided dodecahedron, or even a latitude-longitude tessellated globe." Once the shape is determined, traditional texture-mapping is used to map the textures of the panoramic mosaic to the model.), the image panorama containing features having one or more textures (See Szeliski: Col. 5, Lns. 27-35);
- Determining a directional vector from the three-dimensional geometric surface (See Szeliski: Fig. 15; Col. 22, Lns. 4-31);
- Creating a geometric model of the image panorama based at least in part on the three-dimensional geometric surface and the directional vector (See Szeliski: Col. 7, Lns. 29-33 and Col. 22, Lns. 4-31. In column 7, Szeliski teaches the geometry of the three-dimensional model is a polyhedron, the faces of which constitute the three-dimensional geometric surfaces. In column 22, Szeliski teaches the direction vectors, which are used to align the images of the panoramic

image. Thus, the geometric model of the visual scene is dependent on the geometric shapes of the surfaces of the polyhedron to be texture mapped, and the texture map applied to the surfaces of the polyhedron, which is the panoramic mosaic determined using the direction vectors.);

- Applying the one or more textures to the selected feature in the image panorama based on the geometric model (See Szeliski: Fig. 2B, Item 270; Col. 28, Lns. 13-15, wherein Szeliski teaches, "...efficiently computing texture map color values for any geometry and choice of texture map coordinates.").

Szeliski does not expressly disclose associating geometry information with a selected feature, or that the geometry information comprising 3-D coordinates describing the position and orientation of a selected feature in a reference coordinate system. Seago is cited for selecting an object contained within the two-dimensional perspective image for conversion into a three-dimensional object by a user (See Seago: Fig. 2, Item 42; Col. 4, Lns. 46-53), as associating with it shapes or polygons that define the selected object's sides relates to the geometry information (See Seago: Fig. 2, Item 50; Col. 5, Lns. 35-38). The geometry of the 3D object is then oriented within the selected object's three-dimensional coordinate space

(See Seago: Fig. 2, Item 54; Col. 5, Lns. 50-53). It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to have used the three-dimensional object extraction method, as taught by Seago, to extract three-dimensional objects from the perspective images of the panoramic mosaic, as taught by Szeliski, for the reasons provided in claim 11.

Regarding independent claim 36, Szeliski teaches a system for interactively editing objects in a panoramic image, the system comprising:

- A receiver for receiving one or more image panoramas representing a visual scene having one or more objects (See Szeliski: Fig. 2B, Item 210; Col. 4, Lns. 66-67, wherein the invention creates full view panoramic mosaics from image sequences. Col. 11, Lns. 16-21 teaches the presence of objects within the panoramic images.) and a point source (See Szeliski: Fig. 3, Item 310; Col. 9, Lns. 56-57, wherein the point source is camera 310 having its optical center fixed at point C.);
- A modeling module for creating a three dimensional model of the visual scene (See Szeliski: Col. 3, Lns. 58-61, wherein the post-

processing stage projects mosaics onto a convenient viewing surface, i.e., to create an environment map represented as a texture-mapped polyhedron surrounding the origin, which corresponds to a three-dimensional model of the visual scene.).

Szeliski does not expressly disclose

- Identifying a selected object in the one or more image panoramas and associating geometry information with the selected object, the geometry information comprising 3-D coordinates describing the position and orientation of the selected object in a reference coordinate system,
- One or more interactive editing tools for providing an edit to the selected object;
- A transformation module for transforming the edit relative to a viewpoint defined by the point source; and
- A rendering module for projecting the transformed edit onto the selected object.

Nevertheless, Seago is cited for selecting an object contained within the two-dimensional perspective image for conversion into a three-dimensional object by a user (See Seago: Fig. 2, Item 42; Col. 4, Lns. 46-53), as associating with it shapes or polygons that define the selected

object's sides relates to the geometry information (See Seago: Fig. 2, Item 50; Col. 5, Lns. 35-38). The geometry of the 3D object is then oriented within the selected object's three-dimensional coordinate space (See Seago: Fig. 2, Item 54; Col. 5, Lns. 50-53).

Seago also teaches generating a three-dimensional object based on the designated shapes performed using the graphical interface tools (See Seago: Figs. 9, 10, and 12; Col. 3, Lns. 61-64) and allowing a user to manually correct objects by using the user interface (See Seago: Col. 7, Lns. 56-60).

Furthermore, Seago teaches a transforming module and a rendering module as software subroutines that edit an object, transform the edited object into 2D coordinates, and render the edited object by projecting the transformed object to image plane along the line-of-sight. The line-of-sight corresponds to the viewpoint, and therefore the transform of the edit occurs relative to the viewpoint defined by the point source (See Seago: Fig. 3; Col. 6, Lns. 1-34).

As previously noted, the exemplary embodiment of Seago only uses a single input image as input for the extraction process, but does suggest

using two or more input images (See Seago: Col. 11, Lns. 45-47). Therefore, examiner believes the process of Seago would reasonable extract three-dimensional images from the panoramic mosaics created by Szeliski.

Therefore, it would have been obvious to one of ordinary skill in the art, at the time the invention was made, to have used the three-dimensional object extraction method, as taught by Seago, to extract three-dimensional objects from the perspective images of the panoramic mosaic, as taught by Szeliski, for the reasons given in the analysis of claim 11.

Regarding claim 12, as it depends from claim 11, Szeliski teaches the three-dimensional model comprises at least one of depth information and geometry information (See Szeliski: Figs. 2B, 27, 30 and 32; Col. 29, Lns. 58-61, wherein a “3D model” implies geometric shape, as well as height, width, and depth.).

Regarding claim 23, as it depends from claim 22, Szeliski teaches a method wherein the instructions are received using an interactive drawing tool (See Szeliski: Fig. 2A, Item 42; Col. 8, Lns. 30-32).

Regarding claim 24, as it depends from claim 22, Szeliski teaches a method wherein the three-dimensional geometric surface is one of a floor, a wall, or a ceiling (See Szeliski: Col. 27, Lns. 64-67, wherein the model can be a cube with six separate texture maps for each surface. Using an appropriate environment map would cause the top surface to be a ceiling, the bottom surface to be a floor, etc.).

Regarding claim 25, as it depends from claim 22, Szeliski teaches a method wherein the directional vector is orthogonal to the planar surface (See Szeliski: Fig. 15; Col. 22, Lns. 4-6).

Regarding claim 26, as it depends from claim 22, Szeliski teaches a method wherein the geometric model comprises depth information (See Szeliski: Figs. 27 and 30; Col. 28, Lns. 29-33).

Regarding claim 27, as it depends from claim 22, Szeliski teaches a method wherein the texture information comprises color information (See Szeliski: Col. 28, Lns. 13-18).

Regarding claim 28, as it depends from claim 22, Szeliski teaches a method comprising environment based texture mapping comprises

luminance information (See Szeliski: Fig. 2B; Col. 5, Lns. 27-30, wherein luminance is inherent to environment maps and texture maps.).

C. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Szeliski, in view of Luken and Seago, and in further view of Blank (US Patent Number 5,469,536).

Regarding claim 7, as it depends from claim 6, the combination of Szeliski, Luken, and Seago does not expressly suggest using edge detection to automatically identify the two elements. Nevertheless, Blank teaches detecting the edges of an object and separates portions of the image that are outside the edge of the object (i.e., the background component) from portions of the image that are inside the edge (See Blank: Col. 4, Lns. 17-21). The two elements are therefore identified as those elements within the edge, and those outside the edge. It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to have used the edge detection methods, as taught by Blank, as an alternative to patch-based division, as taught by Szeliski, as modified by Luken and Seago, because it is an effective way to divide the image into smaller portions to conquer aligning all aspects of an image.

D. Claims 13-21 and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Szeliski, in view of Seago, and in further view of Blank.

Regarding claim 13, as it depends from claim 11, the combination of Szeliski and Seago does not expressly suggest receiving an edit to color information associated with the objects of the image. Blank is cited for teaching editing an image having a plurality of pixels, each pixel having a color, comprising the steps of selecting a plurality of colors from among those present in the image to form a set of selected colors, and manipulating only those pixels having a color defined in the set of selected colors so as to change a visual feature of the image (See Blank: Col. 6, Lns. 29-47). It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to have allowed modification of the colors within an image, as taught by Blank, to manipulate the colors within the images used to create the panoramic image mosaics, as taught by Szeliski, as modified by Seago, because it would enable the user to quickly and efficiently modify or enhance the appearance of an image to desired goal (See Blank: Col. 6, Lns. 23-28).

Regarding claim 14, as it depends from claim 11, the combination of Szeliski and Seago does not expressly suggest receiving an edit to alpha

information associated with the objects of the image. Blank is cited for teaching determining whether to reset the transparency alpha-bit flag. If the transparency flag is reset, it is set to opaque (See Blank: Fig. 11; Col. 20, Lns. 61-66). It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to have allowed modification of the alpha values within an image, as taught by Blank, to control the presentation of the images of the panoramic image mosaics, as taught by Szeliski, as modified by Seago, for the same reasons given in claim 13.

Regarding claim 15, as it depends from claim 11, the combination of Szeliski and Seago does not expressly suggest receiving an edit to depth information associated with the objects of the image. Blank is cited for moving several objects to various Z depth layers (See Blank: Col. 13, Lns. 8-16). It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to have moved objects in three-dimensions, as taught by Blank, to manipulate the objects extracted from the mosaics, as taught by the combination of Szeliski and Seago, for the same reasons given in claim 13.

Regarding claim 16, as it depends from claim 11, the combination of Szeliski and Seago does not expressly suggest receiving an edit to

geometry information associated with the objects of the image. Blank is cited for teaching trimming, which allows the user to trim off any undesired edges of an object to reveal the background below (See Blank: Col. 47, Lns. 11-20). It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to have used a manipulation tools, as taught by Blank, to manipulate the objects extracted from the panoramic image mosaics, as taught by Szeliski, as modified by Seago, for the same reasons given in claim 13.

Regarding claim 17, as it depends from claim 11, the combination of Szeliski and Seago does not expressly suggest providing a user with an interactive drawing tool that specifies edits for one or more objects of the image or receiving the edits made by the user using the interactive drawing tool. Blank is cited for teaching function calls, wherein attributes to be changed are pre-selected or selected by the user. When function is accessed by a user call, the system operates as a highly interactive and very powerful image editing tool. The function accesses preset gamma attributes, layer, and object or area selections, e.g., all pixels on layer one with a hue of blue at a value range of 10 to 75 (See Blank: Col. 21, Lns. 18-23) It would have been obvious to one of ordinary

skill in the art, at the time the invention was made, to have used manipulation tools, as taught by Blank, to manipulate the objects extracted from the panoramic image mosaics, as modified by Seago, for the same reasons given in claim 13.

Regarding claims 18 and 37, as they depend from claims 17 and 36, respectively, the combination of Szeliski and Seago does not expressly suggest the interactive drawing tool is one of an extrusion tool, a ground plane tool, a depth chisel tool, and a non-uniform rational B-spline tool. Blank is cited for teaching trimming, which allows the user to trim off any undesired edges of an object to reveal the background below, which corresponds to the depth chisel tool (See Blank: Col. 47, Lns. 11-20). It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to have used a manipulation tools, as taught by Blank, to manipulate the objects extracted from the panoramic image mosaics, as taught by Szeliski, as modified by Seago, for the same reasons given in claim 13.

Regarding claim 19, as it depends from claim 17, the combination of Szeliski and Seago does not expressly suggest interactive drawing tool specifies a selected value for depth for objects of the image. Blank is cited

for teaching tests to see if an object is at the top layer (Z=31) or at the bottom layer (Z=0) (See Blank: Col. 22, Lns. 35-62). It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to have used a manipulation tools, as taught by Blank, to manipulate the objects extracted from the panoramic image mosaics, as taught by Szeliski, as modified by Seago, for the same reasons given in claim 13.

Regarding claim 20, as it depends from claim 17, the combination of Szeliski and Seago does not expressly suggest the interactive drawing tool incrementally adds to the depth for objects of the image. Blank is cited for teaching area addition, which allows the user to add additional selections to the current selection. Once the user clicks the area addition tool, "add" mode is retained until it is clicked again or switched to a different selection tool (drag box, drag free, color select, or brush select) (See Blank: Col. 34, Lns. 8-11). It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to have used a manipulation tools, as taught by Blank, to manipulate the objects extracted from the panoramic image mosaics, as taught by Szeliski, as modified by Seago, for the same reasons given in claim 13.

Regarding claim 21, as it depends from claim 17, the combination of Szeliski and Seago does not expressly suggest the interactive drawing tool incrementally subtracts from the depth for objects of the image. Blank is cited for teaching area subtraction, which allows the user to deselect certain regions of the currently selected area. Click on the Area Subtraction tool and select areas to be subtracted. Again, "subtract" mode is retained until it is clicked again or switched to a different selection tool (drag box, drag free, color select, or brush select) (See Blank: Col. 34, Lns. 22-26). It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to have used a manipulation tools, as taught by Blank, to manipulate the objects extracted from the panoramic image mosaics, as taught by Szeliski, as modified by Seago, for the same reasons given in claim 13.

IV. Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Crystal Murdoch whose telephone number is (571) 270-1043. The examiner can normally be reached on Mon. - Fri. 10:00am - 6:30pm. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor,

Mark Zimmerman can be reached on (571) 272-7653. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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